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Signed J Evans.

Dated 11 January 2005

Patents Form 1/77

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21NOV03 E854099-1 D00790
P01/7700 0.00-0327138.4

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

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The Patent Office
Cardiff Road
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1. Your reference — PA 4861

2. Patent application number *(The Patent Office will fill this part in)* — 0327138.4 — 2 1 NOV 2003

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

UCL Biomedica plc
Royal Free & University College Medical School
University College London, Royal Free Campus
Rowland Hill Street
London, NW3 2PF
United Kingdom

Patents ADP number *(if you know it)* 8758211001

If the applicant is a corporate body, give the country/state of its incorporation — United Kingdom

4. Title of the invention — MATTRESS PROTECTION

5. Name of your agent *(if you have one)* — SOMMERVILLE & RUSHTON

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

45 Grosvenor Road
St Albans
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Patents ADP number *(if you know it)* — 1511001 ✓

6. Priority: Complete this section if you are declaring priority from one or more earlier patent applications, filed in the last 12 months.

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. Divisionals, etc: Complete this section only if this application is a divisional application or resulted from an entitlement dispute *(see note f)*

Number of earlier UK application	Date of filing *(day / month / year)*

8. Is a Patents Form 7/77 (Statement of inventorship and of right to grant of a patent) required in support of this request? — YES

Answer YES if:
a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
Otherwise answer NO (See note d)

Patents Form 1/77

9. Accompanying documents: A patent application must include a description of the invention. Not counting duplicates, please enter the number of pages of each item accompanying this form:

Continuation sheets of this form	
Description	5
Claim(s)	2
Abstract	1
Drawing(s)	2 only

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10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent (Patents Form 7/77)	
Request for a preliminary examination and search (Patents Form 9/77)	
Request for a substantive examination (Patents Form 10/77)	
Any other documents (please specify)	

11. I/We request the grant of a patent on the basis of this application.

Signature(s) Date 21 November 2003

12. Name, daytime telephone number and e-mail address, if any, of person to contact in the United Kingdom

Iain Whitaker
01727 854215

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After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

a) If you need help to fill in this form or you have any questions, please contact the Patent Office on 08459 500505.

b) Write your answers in capital letters using black ink or you may type them.

c) If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.

d) If you have answered YES in part 8, a Patents Form 7/77 will need to be filed.

e) Once you have filled in the form you must remember to sign and date it.

f) Part 7 should only be completed when a divisional application is being made under section 15(4), or when an application is being made under section 8(3), 12(6) or 37(4) following an entitlement dispute. By completing part 7 you are requesting that this application takes the same filing date as an earlier UK application. If you want the new application to have the same priority date(s) as the earlier UK application, you should also complete part 6 with the priority details.

Mattress Protection

Field of the Invention

The present invention concerns improvements in and relating to mattress protectors and provides methods and means for monitoring the integrity of a mattress protector to determine if bodily fluids have penetrated through to the mattress.

Background to the Invention

Hospital mattresses form the platform for delivering routine care to patients. In recent years increasing attention has been paid to their specifications, including their ability to improve comfort for patients, prevent pressure ulcers, appropriately stabilise patients with fractures or following surgery, reduce the risk of rolling off the mattress, and facilitate nursing management of the patients including toileting. A further requirement is that mattress covers be impenetrable to body fluids so that the inner core, which usually comprises a composite of foams, does not become contaminated. Once the integrity of the cover has been breached (technically known as "strike-through"), the potential for the mattress core to become a medium for the growth of bacteria and fungal spores is high. The combined presence of moisture, infectious agents and the warmth continuously generated by the multiple users of the mattress is an ideal incubation environment for pathogens.

In September 1999 the Medical Devices Agency issued a Safety Notice (MDA SN1999 (31) alerting hospitals of the hazards to staff and patients associated with mattresses in poor condition. In recent years procedures for supplying and servicing mattresses in hospitals have changed. Traditionally nursing staff have ordered, cleaned and audited the condition of mattresses, but with increasing pressure on their time, non-patient contact activities such as mattress management are being increasingly devolved to non-nursing staff. The UK is leading Europe in the implementation of "total mattress management" and "total bed management" contracts where the manufacturer/distributors of hospital mattress are contracted to supply mattresses against clinical and technical specifications. These specifications are led by the NHS Purchasing and Supply Agency (PASA).

Under these arrangements contractors undertake the responsibility of not only supplying hospital mattresses but also auditing their condition, ensuring that worn or leaking mattresses are withdrawn and replaced. At present this entails technicians undertaking a "sweep" through the hospital inspecting mattresses individually, physically checking for deterioration of the mechanical support characteristics of the mattress core, and inspecting for evidence of "strike-through". This is a very unpleasant process and may also represent a potential health and safety risk to staff undertaking the audits.

This invention seeks as one objective to provide a new technology to enable mattress audit technicians or hospital staff to determine whether a mattress cover has leaked at any time in the mattress' service, without removing the cover. Avoiding the necessity of removing the mattress cover both simplifies the task and reduces the risk of infections spreading.

Summary of the Invention

According to a first aspect of the present invention there is provided a mattress protector to shield a mattress or mattress core from body fluids, the protector comprising a substantially liquid-impermeable cover for the mattress or mattress core and a detector within the cover or below or in an under layer of the cover to detect body fluid that has passed into or through the cover. The protector may be separate from or integral with a mattress and, in the latter case, may comprise all or part of the casing that envelopes the mattress core. The substantially liquid-impermeable cover is preferably breathable.

In a first preferred embodiment of the invention the cover is a transparent cover for a mattress with an inter-layer or under-layer, suitably an absorbent under-layer, having a dye that is activated by a body fluid to provide a visual indication of presence of the body fluid. The inter- or under-layer is preferably impregnated with the dye.

The dye is preferably unaffected by water vapour. However, if body fluid such as urine penetrates through the mattress, indicators in the dye will show through the

transparent cover. An indicator specific to urine and unaffected by water (many of which are commercially available and are used, for example, to expose urination in swimming pools) is advantageous, since water vapour may be present in the mattress during correct functioning of the cover, where the cover is specified to be "breathable", i.e. transmits water vapour.

Preferably, the absorbent layer is made from a stretchable material, suitably crepe or similar, in order to minimise perturbation of the cover stretch properties. Alternatively, incisions could be made in the absorbent sheet, similar to those in lattice pastry or expanded sheet metal, so as to allow stretch in the sheet material.

In a second preferred embodiment of the invention, instead of having a dye-based detector the detector comprises an apparatus that monitors electrical conductivity. This suitably uses electrically conductive threads or fibres such as, for example, an electrically conductive yarn (eg, silver plated nylon), forming rows or a matrix over the inter- or under-layer. Suitably the threads form the warp or weft of a thin flexible woven under- layer.

Preferably the mattress in this second embodiment is fitted with a small processor, preferably a micro-processor, which monitors the electrical conductivity between neighbouring conductive threads in the sensing layer and records any change.

In the event of a leak of ionic (electrically conductive) fluid, as all body fluids are, a short circuit between threads will be detected and recorded. The micro-processor may have a very low power consumption and could be battery-powered and be interrogated using an inductive link by an external device to determine if any leak events had occurred.

Brief Description of the Drawings

The preferred embodiments of the present invention will now be more particularly described by way of example with reference to the accompanying drawings, wherein:

Figure 1 is a sectional view of an end of a mattress encased in the mattress protector of the first preferred embodiment;

Figure 2 is an isometric view of a mattress encased in a mattress protector of the second preferred embodiment, showing the outer cover part cut-away to view the matrix of electrically conductive yarn that underlies the outer cover; and

Figure 3 is a schematic circuit diagram for the electrical conductivity-based detector of the second preferred embodiment.

Description of the Preferred Embodiments

In the first preferred embodiment, illustrated in Figure 1, a transparent cover 3 is provided for the mattress 1, with an absorbent under-layer 2 impregnated with a dye that is activated by a body fluid such as urine but not by water vapour. If urine penetrates through the mattress indicators in the dye show through the transparent cover. An indicator specific to urine, or rather specific for organic compounds such as urea or glucose present in urine, is advantageous, since water vapour may be present in the mattress during correct functioning of the cover. Many mattress covers are specified to be "breathable", i.e. they transmit water vapour. Alternatively, a moisture-sensitive dye sensitive to a threshold level of moisture greater than that prevalent as water vapour may be used.

The absorbent layer is here stretchable, suitably being made from a stretchable fabric, eg a crepe-style material, or is incised/ partitioned, in order to minimise perturbation of the cover stretch properties.

In the second preferred embodiment illustrated in Figures 2 and 3, threads of electrically conductive silver plated nylon yarn are used forming the warp or weft of a thin flexible woven under layer 6 of the mattress protector beneath the substantially liquid impermeable shielding layer 5 of the cover. The mattress 4 is fitted with a small microprocessor 7, which monitors the electrical conductivity between neighbouring conductive threads 12, 13 in the sensing layer 6. In the event of a leak of ionic (electrically conductive) fluid, a short circuit between threads is detected via the threads 12,13 and recorded by the microprocessor 7. The microprocessor 7 has a very low power consumption and is thus battery powered and entirely self-contained. It can be interrogated using an inductive link by an external device to determine if any leak events had occurred.

Referring to Figure 3, a battery 8 supplies power to the microprocessor 7 as well as supplying positive and negative threads 12 and 13 respectively. The presence of an electrolyte such as urine 10 causes a short circuit between the two threads 12 and 13, so changing the high/low state monitored at digital input 11 to the microprocessor 7. This event is stored in the memory of the microprocessor 7.

At some subsequent occasion, the assembly is interrogated by means of a radio wand, the signal of which is picked up by antenna 14. This causes the microprocessor 7 to respond with an appropriate signal to indicate whether a short has occurred at any time in the past.

This remote interrogation of the microprocessor 7 can take place using conventional RFID technology, without the necessity of removing the mattress cover 5 (so causing a spread of infection), or even the bedclothes.

Claims

1. A mattress protector to shield a mattress or mattress core from body fluids, the protector comprising a shielding cover for the mattress or mattress core and a detector within the cover or below or in an under layer of the cover to detect body fluid that has passed into or through the cover.

2. A mattress protector as claimed in Claim 1, wherein the cover is a transparent cover for a mattress with an inter-layer or under-layer having a dye that is activated by a body fluid to provide a visual indication of presence of the body fluid.

3. A mattress protector as claimed in Claim 2, wherein the dye is not reactive to water vapour.

4. A mattress protector as claimed in Claim 3, wherein the dye is specifically reactive to one or more organic compounds in urine, and/or other body fluids.

5. A mattress protector as claimed in any preceding claim, wherein the inter-layer or under-layer is absorbent.

6. A mattress protector as claimed in any preceding claim, wherein the inter-layer or under-layer is made from a stretchable material or has incisions or is otherwise adapted to stretch.

7. A mattress protector as claimed in Claim 1, 5, 6 or 7, wherein the detector comprises electrically conductive material in or associated with the inter-layer or under-layer whereby the detector responds to changes in electrical conductivity to detect body fluid that has passed through the cover

8. A mattress protector as claimed in Claim 7, wherein the detector comprises electrically conductive threads or fibres.

9. A mattress protector as claimed in Claim 8, wherein the electrically conductive threads or fibres are configured in rows or a matrix over the inter-layer or under-layer.

10. A mattress protector as claimed in Claim 8 or 9, wherein the electrically conductive threads form the warp or weft of the inter-layer or under layer.

11. A mattress protector as claimed in Claim 8, which further comprises a processor which monitors the electrical conductivity between neighbouring conductive threads so that in the event of a leak of ionic (electrically conductive) fluid into or through the mattress protector, a short circuit between threads will be detected and recorded.

12. A mattress protector as claimed in Claim 11, wherein the processor is a microprocessor integrated with the protector and adapted to be interrogated by an external device to determine if any leak events had occurred.

13. A mattress protector as claimed in Claim 12, wherein the microprocessor is within or below the cover and is adapted to be interrogated by an inductive link.

14. A mattress protector as claimed in any preceding claim in combination with a mattress.

15. A mattress core encased in a mattress protector of any of Claims 1 to 13.

16. A mattress protector substantially as hereinbefore described with reference to the accompanying drawings.

ABSTRACT

Mattress Protection

The present invention seeks to address the chronic and worsening problem of mattress management in hospitals by providing a mattress protector to shield a mattress or mattress core from body fluids, the protector not only comprising a shielding cover for the mattress or mattress core but also a detector in an inter- or under-layer of the cover to detect body fluid that has passed into or through the cover.

The detector may be chemical, with the cover being a transparent cover and the under-layer being absorbent and having a dye that is activated by a body fluid to provide a visual indication of presence of the body fluid.

In an alternative embodiment the detector may be an apparatus monitoring electrical conductivity. This suitably uses threads of electrically conductive yarn forming either the warp or weft of a thin flexible under layer of the protective cover and which are linked to a small processor which monitors the electrical conductivity between neighbouring conductive threads in the sensing layer.

FIGURE 2

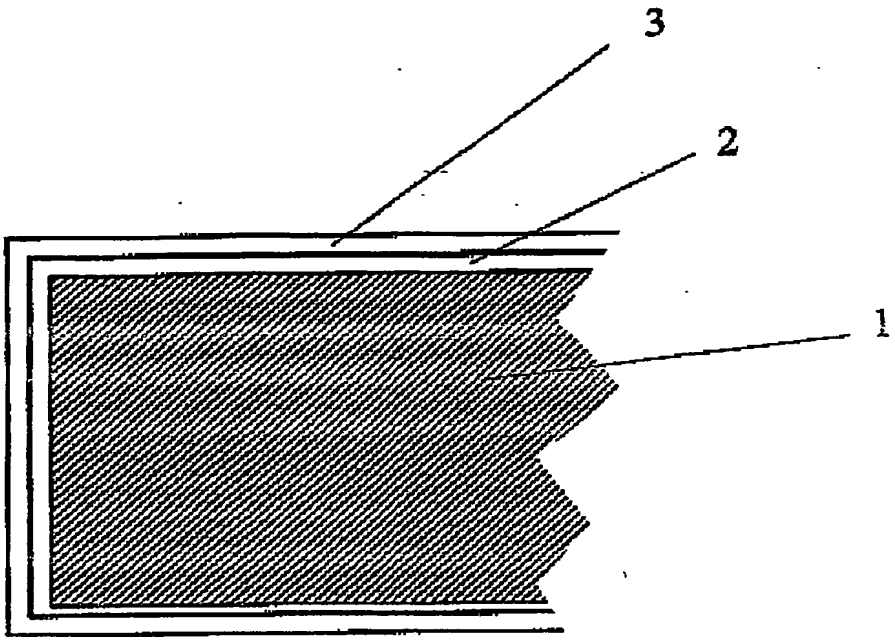

Figure 1

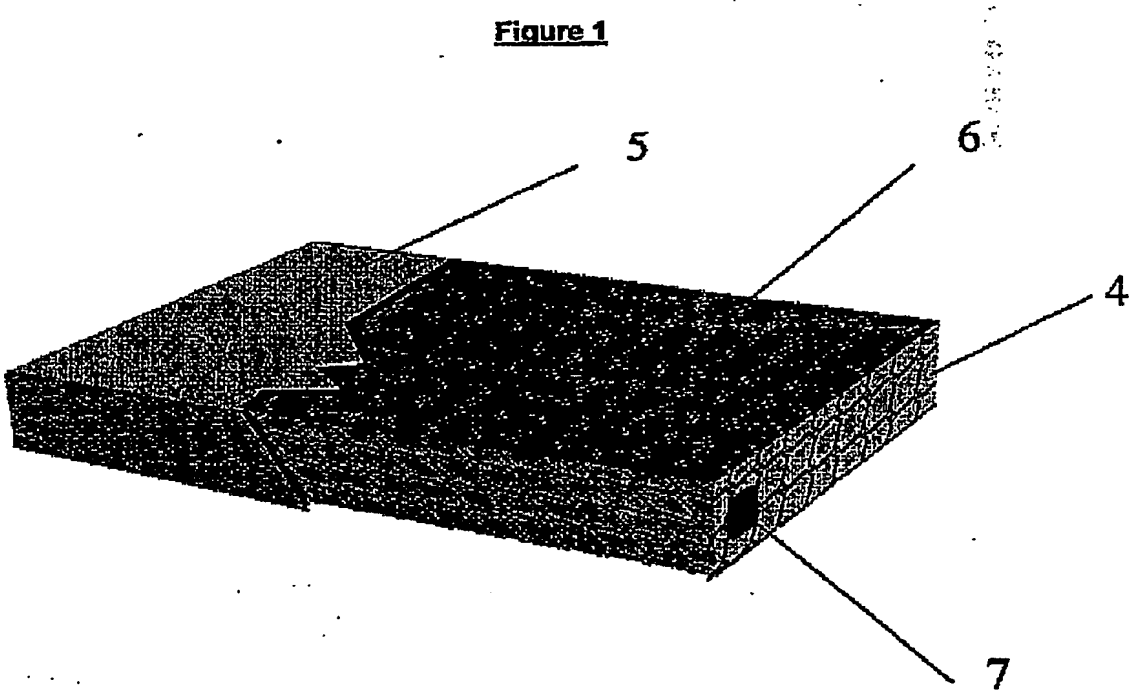

Figure 2

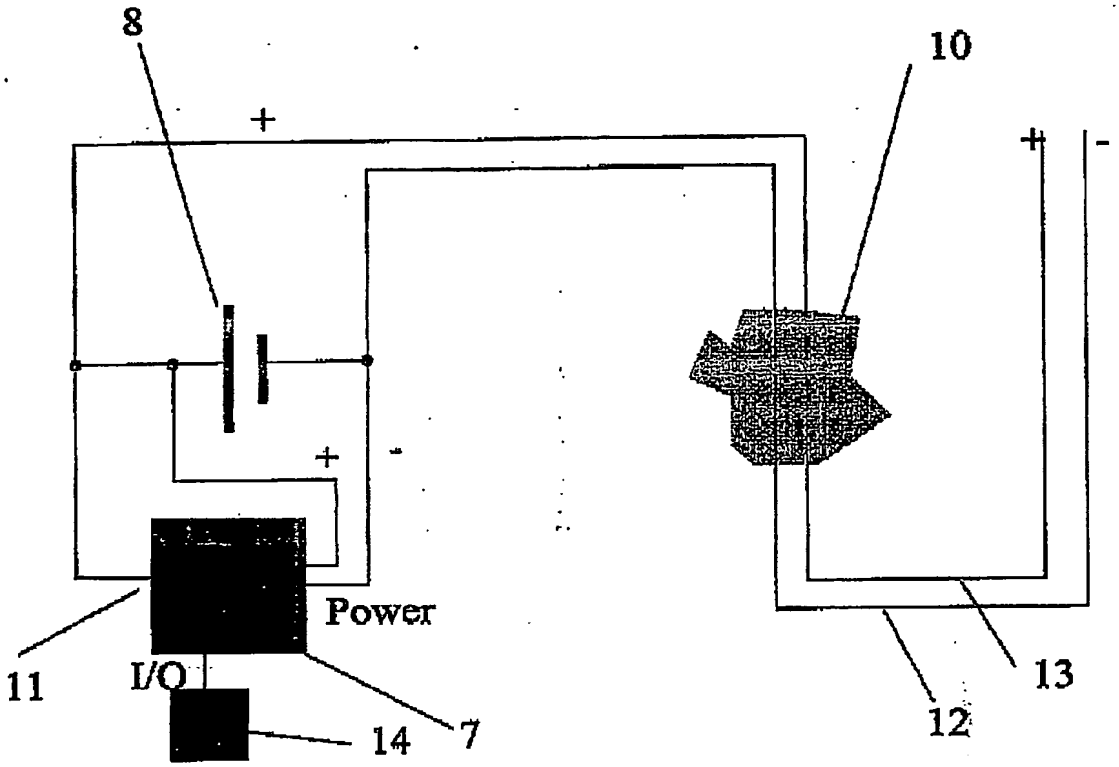

Figure 3

Document made available under the Patent Cooperation Treaty (PCT)

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